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EFFECT OF SWEET POTATO BASED RATION ON PHYSIOLOGICAL AND BLOOD PROFILE OF BROILER RABBIT

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ABSTRACT

Two breeds of broiler rabbits raised on rations containing various levels of sweet potato (Ipomoea batatas) as an energy source at ICAR Research Complex for NEH, Barapani, and Meghalaya. Five groups of each weaned New Zealand White (NZ) and Soviet Chinchilla (SC) rabbits, six in each group were fed five isonitrogenous concentrate mixtures containing 0,10,20,30 and 40 percent boiled sweet potato replacing equivalent amount of maize grain for a period of 45 days. Sweet potato feeding influenced the physiological and blood profile of experimental rabbit. In the present investigation the physiological parameters did not shown any significant variation except respiration rate among the breed except respiration rate. Incorporation of sweet potato tuber in the ration and its feeding did not influence on the concentration of serum cholesterol, blood glucose, calcium and phosphorus contents; however, total protein was affected. The groups that consumed sweet potato based rations differ significantly P P<0.01) with control group. The lower values of total serum protein following feeding of sweet potato incorporated diet might be due to lower retention of digested nitrogen, increase urinary nitrogen loss or incomplete digestion of protein available in sweet potato. The present study also reveals that there was no influence of breed in serum protein levels. Both in NZ and SC rabbit serum protein level decreased due to replacement of maize with sweet potato in ration.

KEYWORDS: Rabbit, Sweet Potato, Feeding, Physiological & Blood Parameters

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Original Article

INTRODUCTION

Broiler rabbit production is a profitable venture and practiced in many countries in the world and as well as in India also (Chakrabarti *et al*, 2014). Rabbit meat is tasty, with considerable juiciness and tenderness. In comparison to other meat, rabbit meat has high biological value, high in protein (20 to 21%) and low in fat (8 to 10%), more particularly very low level of cholesterol (only 25 mg/100 gm fat). Besides this it is richer in certain minerals and vitamins than other kind of meats (Scholaut, 1981; Lebas, 1986). The fat of rabbit carcass contains less stearic (6.3%) and oleic acids (31.2%) than other species and higher proportion of essential polyunsaturated fatty acid (PUFA). The rabbit meat is white, fine grained, delicately flavored, nutritious and appetizing (Cheeke *et al*., 1982). Thus it is not only highly nutritious but also suitable as special diets for heart disease patients and aged people. Saikia (1998) opined that in recent years the rabbit has not only been utilized extensively for biomedical research as laboratory animals but the importance of this animal as a supplier of meat for human consumption is widely recognized throughout the world.

Proven genetic makeup of the animal, balanced feed and good health cover are the major contributing factors to augmenting the productivity of the animal. The easiest way to predict normal health of the animal is the regular monitoring of the physiological parameters like, body temperature, respiration and pulse rate and some of the important blood constituent viz. protein, cholesterol, blood glucose, calcium and phosphorus. Besides environmental factors, imbalanced feeding in terms of nutritional value might affect the above physiological parameters and blood constituents. Blood constituents could be considered as a mirror that reflects the physiological/ metabolical changes taking place in the animal body. Levels of various formed elements and metabolites at blood vary considerably depending upon the internal and external environment of the body. Hence, five blood metabolites namely total protein, cholesterol, glucose, calcium and phosphorus were chosen to study as indicators of the metabolic reaction in rabbits following feeding of different sweet potato based rations.

MATERIALS AND METHODS

A 45 days feeding trial was conducted at Rabbit Research Farm, ICAR Research Complex for NEH Region, Umium, Meghalaya located at an altitude of 980 m above mean sea level and lying between 25°30′ N and 91°51′ E. Thirty weaned New Zealand White (NZ) and thirty weaned Soviet Chinchilla (SC) rabbits of 42 days old were divided randomly into five groups of six animals each as per uniformity in their body weight. The experimental rabbits were reared under uniform manage mental conditions by housing them individually in clean metallic cages, fitted with feeders and waterers and kept inside well ventilated shed with cemented floor. Five isonitrogenous concentrate mixtures (Ration 1, 2, 3, 4 and 5) with 16% crude protein and 70% total digestible nutrients were prepared with conventional feed ingredients like maize, wheat bran, deoiled rice bran, soya bean meal, ground nut cake, rice husk, fish meal, mineral mixture and common salt. In experimental Ration 2, 3, 4 and 5 maize was replaced by sweet potato at the rate of 25, 50, 75 and 100 per cent level (w/w), respectively.

Physiological Responses: Rectal Temperature (RT) was recorded in ^{0}C by using Hicks Clinical thermometer twice a week in the morning and evening. Respiration Rate (RR) was recorded by counting flank movement over an undisturbed period of one minute in the morning and evening twice a week. Pulse rate (PR) was measured by counting the heart beats for a minute with the help of clinical stethoscope in the morning and evening twice a week. Then average RT, RR and PR in different weeks were calculated.

Collection of Blood and Estimation Procedure: Blood samples were collected from the individual animal before the start of the feeding trial (0 day) and at 22nd day and on 45th day i.e. on the end of the trial by piercing the ear vein in the morning between 7 A.M. to 8 A.M. before feeding and watering under strict hygienic and sterilized condition. Collected blood from individual animal was carefully transferred in to sterile test tube and another sterile vial containing sodium fluoride as anticoagulant. The collected samples in the test tube were kept undisturbed in a slanting position at room temperature for about 8 hours to facilitate the serum separation. The serum was pipetted out with the help of a sterilized pastured pipette and stored in Laxbro polypropane vials at –20°C. The separated serum was used for assay of total protein, cholesterol, calcium and phosphorus estimation. However, the blood glucose was estimated from vial containing sodium fluoride as anticoagulant.

The total serum protein was estimated by the modified Biuret method as described by Dumas (1971) and Serum cholesterol was estimated by the one step method of Wybenga and Pileggi (1970) as described in the assay protocol of the diagnostic reagent kit manufactured by BEACON Diagnostics Pvt. Ltd., Navsari, India. Blood glucose was estimated by

Folin-Wu (1970) method as described in the assay protocol of the diagnostic reagent kit manufactured by Span Diagnostics Ltd., Sachin, Surat, India. Serum calcium was estimated by the OCPC method with calcium reagent kit (Crest Biosystems, A Division of coral clinical Systems, Goa) as described by Gitelman (1967) and Bagainski (1973). Serum phosphorus was estimated by the method as described by Taussky and Show (1953).

The experiment was conducted in 2 way interaction design (Snedecor and Cochran, 1980) and data were analyzed by using MSTATC package of Computer.

RESULTS AND DISCUSSIONS

Physiological Parameters (Body Temperature, Respiration Rate and Pulse Rate)

Body Temperature: The mean (± SE) values of body temperature at 0 week, 1st week, 2nd week 3rd week, 4th week, 5th week and 6th week for NZ and SC were 37.97 ± 0.10°C, 37.95 ± 0.90°C, 37.95 ± 0.09°C, 37.92 ± 0.10°C, 37.94 ± 0.11°C, 37.92 ± 0.09°C and 37.90 ± 0.06°C, and 38.02 ± 0.09°C, 37.99 ± 0.11°C, 37.98±0.10°C, 37.96 ± 0.10°C, 37.88 ± 0.09°C, 37.96 ± 0.08°C and 37.97 ± 0.09° respectively. There was no significant variation in body temperature in respect of breed (Table 1). There was also no significant difference in body temperature among the experimental groups of both the breeds due to feeding of Ration 1, 2, 3, 4 and 5 at 0 week, 1st week, 3rd week and 6th week of the experimental period. However, there was significant difference in body temperature at 2nd, 4th week and 5th week of the feeding schedule. At 2nd week of the trial, body temperature recorded significantly ($P<0.01$) higher in all sweet potato based ration except Ration 4 group than the control group (Raton 1). At 4th week there was significant ($P<0.05$) variation in body temperature between Ration 1 and 2 with Ration 3 and 5.

The significantly ($P<0.05$) variation in body temperature due to ration × breed was observed in 2nd and 5th week of experimental period (Table 1). Among the NZ breed there was no significant difference at 2nd week in body temperature between NZ_2, NZ_3 and NZ_5. However, body temperature recorded in NZ_4 significantly ($P<0.01$) differed with all the groups. At 5th week of the experimental period significant ($P<0.01$) difference in body temperature was observed among NZ_1, NZ_3 and NZ_5 with NZ_2 and NZ_4. However, there was no significant difference between NZ_2 and NZ_4 and again in NZ_3 and NZ_4. In SC breed at 2nd week SC_1 differenced significantly ($P<0.01$) with all the groups except SC_2 and there was no significant difference between SC_2, SC_3, SC_4 and SC_5. At 5th week there was no significant difference between SC_1, SC_2, SC_4 and SC_5 and again in between SC_2, SC_3, SC_4 and SC_5 groups.

Table 1: The Mean ± S.E. Value of Body Temperature (°C) in Experimental Rabbits of Different Groups

Attribute	Ration					Overall (Breed)
	1	2	3	4	5	
I	II	III	IV	V	VI	VII
0 Week						
NZ	37.97 ±0.21	37.97 ±0.26	38.03 ±0.19	37.90 ±0.27	37.98 ±0.22	37.97 ±0.10
SC	38.10 ±0.22	37.95 ±0.16	38.08 ±0.20	37.93 ±0.21	38.02 ±0.22	38.02 ±0.09
Overall (Ration)	38.03 ±0.15	37.96 ±0.14	38.06 ±0.13	37.92 ±0.17	38.00 ±0.15	37.99 ±0.06
1st Week						
NZ	37.83 ±0.21	37.95 ±0.19	37.98 ±0.22	37.95 ±0.21	38.03 ±0.20	37.95 ±0.09
SC	37.95 ±0.29	38.00 ±0.27	38.07 ±0.22	37.93 ±0.28	37.98 ±0.20	37.99 ±0.11
Overall (Ration)	37.89 ±0.17	37.97 ±0.16	38.02 ±0.15	37.94 ±0.17	38.01 ±0.14	37.97 ±0.07
2nd Week						
NZ	37.88^{ab} ±0.19	38.03^{a} ±0.23	37.98^{a} ±0.20	37.80^{b} ±0.16	38.03^{a} ±0.23	37.95 ±0.09
SC	37.80^{a} ±0.23	37.93^{ab} ±0.22	38.03^{b} ±0.21	38.07^{b} ±0.24	38.05^{b} ±0.22	37.98 ±0.10
Overall (Ration)	37.84^{a} ±0.14	37.98^{b} ±0.15	38.01^{b} ±0.14	37.93^{ab} ±0.14	38.04^{b} ±0.15	37.96 ±0.06
3rd Week						
NZ	37.95 ±0.19	37.90 ±0.28	37.92 ±0.21	37.90 ±0.28	38.02 ±0.26	37.92 ±0.10
SC	37.97 ±0.27	37.95 ±0.24	37.95 ±0.25	37.93 ±0.23	37.98 ±0.26	37.96 ±0.10
Overall (Ration)	37.91 ±0.16	37.92 ±0.18	37.93 ±0.16	37.92 ±0.17	38.00 ±0.18	37.94 ±0.07
4th Week						
NZ	38.02 ±0.25	38.02 ±0.30	37.85 ±0.25	37.93 ±0.27	37.88 ±0.21	37.94 ±0.11
SC	37.95 ±0.20	37.98 ±0.22	37.83 ±0.22	37.83 ±0.21	37.80 ±0.20	37.88 ±0.09
Overall (Ration)	37.98^{a} ±0.15	38.00^{a} ±0.18	37.84^{b} ±0.16	37.88^{ab} ±0.16	37.84^{b} ±0.14	37.91 0.07±
5th Week						
NZ	37.93^{ac} ±0.23	37.78^{b} ±0.25	37.97^{ac} ±0.20	37.88^{bc} ±0.22	38.05^{a} ±0.22	37.92 ±0.09
SC	37.90^{a} ±0.18	38.00^{ab} ±0.20	38.05_{b} ±0.22	37.92^{ab} ±0.19	37.93^{ab} ±0.18	37.96 ±0.08
Overall (Ration)	37.92^{ab} ±0.14	37.89^{a} ±0.15	38.01^{b} ±0.14	37.99^{ac} ±0.14	37.99^{bc} ±0.14	37.94 ±0.06
6th Week						
NZ	37.85 ±0.25	37.93 ±0.21	38.00 ±0.26	37.97 ±0.20	37.75 ±0.18	37.90 ±0.09
SC	37.97 ±0.26	38.02 ±0.21	37.88 ±0.24	38.00 ±0.21	37.97 ±0.20	37.97 ±0.09
Overall (Ration)	37.91 ±0.17	37.97 ±0.14	37.94 ±0.17	37.98 ±0.14	37.86 ±0.13	37.93 ±0.06

N.B. Sub-class averages with at least one superscripts in common (lower case along the row and upper case along the column) do not differ significantly.

Respiration Rate: The mean (± SE) values of respiration rate at 0 week, 1st week, 2nd week, 3rd week, 4th week 5th and 6th week for NZ and SC rabbits were 111.23 ± 0.73, 111.50 ± 1.07, 111.37 ± 1.07, 111.07 ± 1.05, 111.87 ± 0.89, 110.90 ± 1.01 and 110.67 ± 1.03 numbers / minute and 110.90 ± 0.67, 110.80 ± 1.14, 112.23 ± 1.00, 111.93 ± 1.05, 110.40 ± 1.11, 110.63 ± 0.98 and 112.30 ± 1.18 numbers/minute, respectively (Table 2). There was significant variation in overall respiration rate between the NZ and SC breed at 2nd week, 4th week and 6th week. At 2nd and 6th week respiration rate (numbers/minute) was significantly higher in SC breed, whereas in 4th week it was significantly higher in NZ rabbits.

Respiration Rate Due to Ration: There was no significant difference in respiration rate among the experimental groups of NZ and SC breeds due to Ration 1, 2, 3, 4 and 5 at 0 week 1st week, 2nd week, 3rd week and 6th week. However, there was significant difference in respiration rate at 4th and 5th week of the feeding schedule. At 4th week there was no significant difference between Ration 1, 2, 3 and 5 groups and again in Ration 1, 4 and 5 groups. At 5th week there was no significant difference among Ration 1, 3 and 4, Ration 2 and 4 and Ration 2 and 5 groups. However, there was significant different in Ration 1 and 2 and Ration 4 and 5.

Respiration Rate Due to Ration × Breed: The significant variation due to ration x breed was observed in 1st and 4th week of feeding schedule. At 1st week in NZ breed there was no significant different among NZ_1, NZ_2, NZ_4 and NZ_5 groups and again among NZ_3, NZ_4 and NZ_5 groups. However, NZ_3 significantly differed with NZ_1 and NZ_2 groups. At 4th week there was no significant difference among NZ_2, NZ_3, NZ_4 and NZ_5 groups and again in NZ_1 and NZ_5 groups. NZ_1 group significantly differed with all the groups except NZ_5. In SC breed of rabbits there was no significant difference among SC_1, SC_3 and SC_4 group at 1st week of feeding schedule and again among SC_2, SC_4 and SC_5 group and SC_1 and SC_5 group. At 4th week there was no significant difference among SC_1 and SC_4, SC_2 and SC_3 and SC_4 and SC_5 groups.

Table 2: The Mean ± S.E. Value of Respiration Rate (Numbers/ Minute) in Experimental Rabbits of different Groups

Attribute	Ration					Overall (Breed)
	1	2	3	4	5	
I	II	III	IV	V	VI	VII
0 Week						
NZ	111.83 ±1.47	110.50 ±1.19	111.17 ±1.19	111.50 ±1.69	111.17 ±1.74	111.23 ±0.73
SC	111.67 ±1.96	110.50 ±1.82	110.17 ±1.05	110.50 ±0.92	111.67 ±1.52	110.90 ±0.67
Overall (Ration)	111.75 ±1.18	110.50 ±1.26	110.67 ±0.88	111.00 ±1.19	11.42 ±1.12	111.07 ±0.50
1st Week						
NZ	110.33^{a} ±2.44	110.33^{a} ±2.39	113.50^{b} ±2.67	111.83^{ab} ±2.51	111.50^{ab} ±2.60	111.50 ±1.07
SC	110.17^{ac} ±2.87	112.50^{b} ±2.51	109.33^{a} ±2.76	110.33^{ab} ±2.69	111.67^{bc} ±2.60	110.80 ±1.14
Overall (Ration)	110.25 ±1.80	111.42 ±1.68	111.42 ±1.94	111.08 ±1.77	111.58 ±1.76	111.37 ±1.07
2nd Week						
NZ	109.67 ±2.27	112.33 ±2.43	112.00 ±2.58	111.67 ±2.68	111.17 ±2.68	111.37^{A} ±1.07
SC	111.67 ±2.79	111.67 ±2.14	112.33 ±2.30	112.33 ±2.18	112.33 ±2.18	112.23^{B} ±1.00
Overall (Ration)	110.67 ±1.74	112.00 ±1.55	112.17 ±1.65	112.00 ±1.65	112.17 ±1.77	111.80 ±0.73

Table 2: Contd.,						
3rd Week						
NZ	111.00 ±2.42	111.67 ±2.87	110.50 ±2.40	110.00 ±2.48	112.17 ±2.34	111.07 ±1.05
SC	112.00 ±2.48	112.67 ±2.54	111.17 ±1.99	112.67 ±2.72	111.17 ±2.72	111.93 ±1.05
Overall (Ration)	111.50 ±1.66	112.17 ±1.83	110.83 ±1.49	111.33 ±1.80	111.67 ±1.72	111.50 ±0.74
4th Week						
NZ	110.00^{a} ±1.98	113.00^{b} ±2.13	112.17^{b} ±2.04	112.50^{b} ±2.04	111.67^{ab} ±2.23	111.87^{A} ±0.89
SC	112.83^{a} ±2.57	107.50^{b} ±2.53	109.17^{bc} ±2.70	111.83^{ad} ±2.55	110.67^{cd} ±2.33	110.40^{B} ±1.11
Overall (Ration)	111.42^{ab} ±1.61	110.25^{a} ±1.78	110.67^{a} ±1.67	112.17^{b} ±1.56	111.17^{ab} ±1.55	111.13 ±0.71
5th Week						
NZ	111.33 ±2.42	109.67 ±2.89	113.17 ±2.06	111.33 ±2.36	109.00 ±1.86	110.90 ±1.01
SC	112.17 ±2.51	110.00 ±2.71	111.33 ±1.67	110.83 ±2.12	108.83 ±2.34	110.63 ±0.98
Overall (Ration)	111.75^{a} ±1.67	109.83^{bc} ±1.89	112.25^{a} ±1.29	111.08^{ac} ±1.51	108.92^{b} ±1.43	110.77 ±0.70
6th Week						
NZ	109.83 ±2.70	111.33 ±2.70	111.50 ±1.84	110.50 ±2.26	110.17 ±2.65	110.67^{A} ±1.03
SC	112.00 ±3.18	111.33 ±3.33	112.50 ±2.35	112.50 2.49	113.17 ±2.68	112.30^{B} ±1.18
Overall (Ration)	110.92 ±2.02	111.33 ±2.05	112.00 ±1.43	111.50 ±1.63	111.67 ±1.85	111.48 ±0.78

N.B. Sub-class averages with at least one superscripts in common (lower case along the row and upper case along the column) do not differ significantly.

Pulse Rate

The mean (±SE) values of pulse rate at 0 week, 1st week, 2nd week, 3rd week, 4th week, 5th week and 6th week for NZ and SC breed were 138.03 ± 0.87, 139.10 ± 0.72, 138.77 ± 0.83, 138.50 ± 0.91, 137.97 ± 0.78, 138.60 ± 0.86 and 139.67 ± 0.57 (beat/minute) and 137.50 ± 0.76, 139.10 ± 0.66, 138.63 ± 0.70, 138.20 ± 0.85, 138.70 ± 0.86, 138.90 ± 0.89 and 139.60 ± 0.73 beats/minute, respectively (Table 3). There was no significant variation in pulse rate in respect of breed.

Table 3: The Mean ± S.E. Value of Pulse Rate (Numbers/Minute) in Experimental Rabbits of Different Groups

Attribute	Ration					Overall (Breed)
	1	2	3	4	5	
I	II	III	IV	V	VI	VII
0 Week						
NZ	137.50 ±2.04	139.50 ±2.39	137.00 ±1.69	138.83 ±1.96	137.33 ±2.14	138.03 ±0.87
SC	136.67 ±1.87	137.67 ±1.20	138.67 ±2.09	136.67 ±1.72	137.83 ±1.96	137.50 ±0.76
Overall (Ration)	137.08 ±1.33	138.58 ±1.30	137.83 ±1.31	137.75 ±1.28	137.58 ±1.38	137.77 ±0.57
1st Week						
NZ	138.17 ±2.48	139.50 ±1.56	140.00 ±0.97	139.50 ±1.18	138.33 ±1.86	139.10 ±0.72
SC	139.50 ±1.18	139.33 ±1.76	140.00 ±0.97	138.67 ±1.89	138.00 ±1.75	139.10 ±0.66

Table 3: Contd.,						
Overall (Ration)	138.83 ±1.32	139.42 ±1.12	140.00 ±0.65	139.08 ±1.07	138.17 ±1.22	139.10 ±0.48
2nd Week						
NZ	139.00^{ab} ±2.48	138.67^{ab} ±2.03	138.83^{ab} ±0.83	137.50^{a} ±2.35	139.83^{b} ±1.70	138.77 ±0.83
SC	139.17^{ac} ±1.35	135.83^{b} ±1.58	138.33^{a} ±1.50	141.00^{c} ±1.55	138.83^{a} ±1.58	138.63 ±0.70
Overall (Ration)	139.08^{a} ±1.34	137.25^{b} ±1.30	138.58^{ab} ±0.82	139.25^{a} ±1.44	139.33^{a} ±1.12	138.70 ±0.54
3rd Week						
NZ	140.17 ±2.18	137.17 ±2.21	140.00 ±0.97	137.50 ±2.84	137.67 ±1.87	138.50 ±0.91
SC	138.17 ±2.17	138.67 ±1.54	138.83 ±2.34	137.67 ±2.30	137.67 ±1.71	138.20 ±0.85
Overall (Ration)	139.17^{ac} ±1.50	137.92^{ab} ±1.30	139.42^{a} ±1.22	137.58^{b} ±1.74	137.67^{bc} ±1.21	138.35 ±0.62
4th Week						
NZ	137.50 ±2.09	137.17 ±1.74	139.67 ±2.03	136.50 ±1.43	139.00 ±1.61	137.97 ±0.78
SC	138.83 ±1.99	137.00 ±2.05	139.17 ±1.08	139.00 ±2.61	139.50 ±2.14	138.70 ±0.86
Overall (Ration)	138.17 ±1.39	137.08 ±1.28	139.42 ±1.10	137.75 ±1.47	139.25 ±1.28	138.33 ±0.58
5th Week						
NZ	138.00^{ab} ±1.93	140.17^{a} ±2.04	136.33^{b} ±1.96	138.83^{a} ±0.94	139.67^{a} ±2.70	138.60 ±0.86
SC	140.83^{a} ±1.78	140.50^{a} ±2.06	136.83^{b} ±2.38	136.33^{b} ±1.98	140.00^{a} ±1.53	138.90 ±0.89
Overall (Ration)	139.42^{a} ±1.32	140.33^{a} ±1.37	136.58^{b} ±1.47	137.58^{b} ±1.11	139.83^{a} ±1.48	138.75 ±0.61
6th Week						
NZ	140.00 ±1.26	139.83 ±1.72	138.83 ±1.74	139.83 ±1.08	139.83 ±0.70	139.67 ±0.57
SC	138.00^{a} ±1.12	138.17^{a} ±1.92	140.17^{b} ±1.60	140.33^{b} ±2.09	141.33^{b} ±1.38	139.60 ±0.73
Overall (Ration)	139.00 ±0.86	139.00 ±1.25	139.50 ±1.14	140.08 ±1.12	140.58 ±0.77	139.63 ±0.46

N.B. Sub-class averages with at least one superscripts in common (lower case along the row and upper case along the column) do not differ significantly

Pulse Rate Due to Ration: There was no significant difference in pulse rate among the experimental groups of both the breeds due to feeding of Ration 1, 2, 3, 4 and 5 at 0 week, 1st week, 4th week and 6th week of the feeding schedule. However, there was significant difference in pulse rate at 2nd week, 3rd week and 5th week of experimental period. At 2nd week pulse rate recorded similar in Ration 1, 3, 4 and 5 groups and again in Ration 2 and 3 groups. At 3rd week there was no significant difference between Ration 2, 4 and 5 group and Ration 1, 2 and 3 groups. At 5th week the values were similar in Ration 1, 2 and 5 and Ration 3 and 4 groups.

Pulse Rate Due to Ration × Breed: The significant variation in pulse rate due to ration × breed was observed in 2nd, 5th and 6th week of experimental period. Among the NZ breed at 2nd week there was no significant variation in between NZ_1, NZ_2, NZ_3 and NZ_4 groups and NZ_1, NZ_2, NZ_3 and NZ_5 groups. However, there was significant difference between NZ_4 and NZ_5. At 5th week NZ_1, NZ_2, NZ_4 and NZ_5 did not differ significantly among them. Similar observation was

recorded in NZ_1 and NZ_3 groups also. In SC breed at 2nd week there was no significant difference among the SC_1, SC_3 and SC_5 groups and again in SC_1 and SC_4 group. However, SC_2 significantly ($P<0.01$) differed with all other groups. At 5th week the similar observations were recorded in SC_1, SC_2 and SC_5 groups and again in SC_3 and SC_4 groups. At 6th week SC_1 and SC_2 groups significantly differed with SC_3, SC_4 and SC_5 groups and there was no significant difference between SC_1 and SC_2 and again in SC_3, SC_4 and SC_5 groups.

Perusal of the Table 1, 2, 3 reveals that there was no significant variation in body temperature and pulse rate between the NZ and SC breed due to feeding of different rations based on sweet potato. However, respiration rate varied significantly due to breed at some time interval (2nd, 4th and 6th week) of the experimental feeding trial. Although significant variation in body temperature, respiration rate and pulse rate were noted due to ration and ration × breed at some specific time interval of trial among the groups, however, all the values were found to be within the normal range as reported by Das *et al.* (1999), Rohilla and Bujarbaruah (2000a) and Rohilla and Bujarbaruah (2000b). This implied that replacement of maize with sweet potato do not produce any adverse effect on physiological parameters viz. body temperature, respiration rate and pulse rate. The variation on the values of above physiological parameters as observed among some groups of the present study might be associated with diurinal variation by individual animal within physiological limit and ability to digest the feed ingredients.

The present findings on body temperature, respiration rate and pulse rate were comparable with the earlier reports of Das *et al*. (1999), Rohilla and Bujarbaruah (2000a) and Rohilla and Bujarbaruah (2000b). The present findings of non-significant variation in body temperature due to breed was also reported by Das (1998) and Das *et al*. (1999). Earlier workers (Rohilla and Bujarbaruah, 2000a and Rohilla and Bujarbaruah, 2000b) also reported that feeding of *Morus alba* leaves and banana leaves did not produce any significant difference in respect of body temperature and respiration rate.

Blood Biochemical Profiles

Total Serum Protein: The mean (± SE) values of total serum protein in NZ breed maintained with Ration 1, 2, 3, 4 and 5 on 0 day of the experiment were 5.867 ± 0.035, 5.860 ± 0.112, 5.910 ± 0.074, 5.910 ± 0.126 and 5.917 ± 0.066 g/100 ml, respectively. The respective values in SC breed were 5.943 ± 0.030, 5.897 ± 0.104, 5.877 ± 0.029, 5.860 ± 0.107 and 5.937 ± 0.037 g/100 ml, respectively (Table 4). The serum protein level, between the two breeds did not differ significantly due to feeding of different rations. The mean (± SE) values of serum protein in combined breeds viz. NZ and SC maintained on Ration 1, 2, 3, 4 and 5 on 0 day were 5.905 ± 0.027, 5.878 ± 0.069, 5.893 ± 0.038, 5.885 ± 0.075 and 5.927 ± 0.034 g/100, respectively. The serum protein value of the combined breeds did not differ at 0 day of the trial. The mean (± SE) values of total serum protein in NZ breed maintained with Ration 1, 2, 3, 4 and 5 on 22nd day of the experiment were 6.163 ± 0.077, 5.747 ± 0.045, 5.517 ± 0.270, 5.533 ± 0.049 and 5.567 ± 0.219 g/100 ml respectively. The respective values in SC breed were 6.177 ± 0.044, 5.743 ± 0.057, 5.577 ± 0.195, 5.763 ± 0.127 and 5.783 ± 0.059 g/100 ml, respectively.

Table 4: The Mean ± S.E. Value of Total Serum Protein (g/100 ml) in Experimental Rabbits of Different Groups

Attribute	Ration					Overall (Breed)
	1	2	3	4	5	
0 Day (Initial)						
NZ	5.867 ±0.035	5.860 ±0.112	5.910 ±0.074	5.910 ±0.126	5.917 ±0.066	5.893 ±0.034
SC	5.943 ±0.030	5.897 ±0.104	5.877 ±0.029	5.860 ±0.108	5.937 ±0.037	5.903 ±0.028
Overall (Ration)	5.905 ±0.027	5.878 ±0.069	5.893 ±0.036	5.885 ±0.075	5.927 ±0.034	5.898 ±0.022
22nd Day						
NZ	6.163 ±0.077	5.747 ±0.045	5.517 ±0.270	5.533 ±0.049	5.567 ±0.219	5.705 ±0.089
SC	6.177 ±0.044	5.743 ±0.057	5.577 ±0.195	5.763 ±0.127	5.783 ±0.059	5.809 ±0.068
Overall (Ration)	6.170^{a} ±0.040	5.745^{b} ±0.032	5.547^{b} ±0.149	5.648^{b} ±0.080	5.675^{b} ±0.112	5.757 ±0.056
45th Day						
NZ	6.873^{a} ±0.035	5.420^{b} ±0.086	5.523^{b} ±0.055	5.550^{b} ±0.065	5.513^{b} ±0.136	5.776 ±0.150
SC	6.300^{a} ±0.227	5.670^{b} ±0.104	5.647^{b} ±0.061	5.480^{b} ±0.093	5.670^{b} ±0.064	5.753 ±0.089
Overall (Ration)	6.587^{a} ±0.164	5.545^{b} ±0.082	5.585^{b} ±0.046	5.515^{b} ±0.053	5.592^{b} ±0.076	5.765 ±0.086

N.B. Sub-class averages with at least one superscripts in common (lower case along the row and upper case along the column) do not differ significantly.

The mean (± SE) value of serum protein of combined breeds viz. NZ and SC maintained on Ration 1, 2, 3, 4 and 5 on 22nd day were 6.170 ± 0.040, 5.745 ± 0.032, 5.547 ± 0.149, 5.648 ± 0.080 and 5.675 ± 0.112 g/100 ml respectively. The serum protein value of the combined breeds differ significantly (P<0.01) due to feeding of sweet potato based rations (viz. Ration 1, 2, 3, 4 and 5). The groups that consumed sweet potato based rations differ significantly with control group. The mean (±SE) values of total serum protein in NZ breed maintained with Ration 1, 2, 3,4 and 5 on 45th day of the experiment were 6.873 ± 0.035, 5.420 ± 0.086, 5.523 ± 0.056, 5.550 ± 0.065 and 5.513 ± 0.136 g/100 ml, respectively. The respective values in SC breed were 6.300 ± 0.227, 5.670 ± 0.104, 5.647 ± 0.061, 5.480 ± 0.093 and 5.670 ± 0.064 g/100 ml, respectively. The serum protein level differs significantly (P<0.01) due to rations. All the sweet potato based ration groups (viz. Ration 1, 2, 3, 4 and 5) differed significantly with control group that consumed Ration 1 (Table 4). The mean (±SE) value of serum protein in combined breeds viz. NZ and SC maintained on Ration 1, 2, 3, 4 and 5 on 45th day were 6.587 ± 0.164, 5.545 ± 0.082, 5.585 ± 0.046, 5.515 ± 0.053 and 5.592 ± 0.076 g/100 ml, respectively. The serum protein values of combined breed differ significantly (P<0.01) due to incorporation of sweet potato in the ration. The group that consumed Ration 1 (control) group significantly differs with all other group (viz. Ration 2, 3, 4 and 5) that consumed sweet potato based rations.

The average value of serum protein (g/100 ml) recorded in the present study for rabbits of different groups at 0 day (Initial), 22nd day and 45th day (Table 4) were within the reported range of Burroghs, 1971 (5.3 to 7.9 g/100 ml), Harkness and Wagnar, 1980 (5.4 to 7.5 g/100 ml), Raghuramulu *et al.*, 1983 (5.0 to 8.0 g/100 ml) and Kalita *et al.*, 2001 (5.96 to 6.29 g/100 ml). On 0 day of the trial, there was no significant (P<0.05) difference on serum protein level among the groups. However, the serum protein level on 22nd day of the feeding trial differed significantly due to feeding of sweet potato. The serum protein level was significantly higher in control group than recorded in the rabbits, fed with sweet potato

incorporated rations. Limited reports available in literature indicated that serum protein level in rabbits might be affected by unconventional protein replacement schedule as reported by Azim *et al.* (1982), following feeding of potatoes, Kumar (1995) following feeding of neem seed kernel cake and Saikia (1998) following feeding of ajar seed kernel. However, the above workers have not indicated any protein inhibitors present in the unconventional feed in their report. In the present study, sweet potato was used to replace the maize. Sweet potato known to be containing trypsin inhibits (Tomita *et al*., 1985, Lin *et al*., 1988). As indicated in the materials and methods, in the present study attempt was made to remove the trypsin inhibition if any present in the sweet potato. It might also be possible that the present method of removing trypsin inhibitor was not hundred percent effective (Martinez and Dominguez, 1990).

In the present experiment the lower values of total serum protein following feeding of sweet potato incorporated diet might be due to lower retention of digested nitrogen, increase urinary nitrogen loss or incomplete digestion of protein available in sweet potato. The present study also reveals that there was no influence of breed in serum protein levels. Both in NZ and SC rabbit serum protein level decreased due to replacement of maize with sweet potato in ration. Earlier, Chiericato *et al.* (1985) also reported that breed of rabbits did not affect serum profile levels.

Serum Cholesterol: The mean (± SE) values of serum cholesterol in NZ breed maintained with Ration 1, 2, 3, 4 and 5 on 0 day of the experiment were 46.073 ± 0.472, 45.513 ± 0.705, 46.477 ± 0.628, 46.337 ± 0.644 and 45.310 ± 0.497 mg/100 ml, respectively. The respective value in SC breed were 46.740 ± 1.195, 46.030 ± 1.201, 45.520 ± 0.638, 46.213 ± 0.339 and 46.177 ± 0.368 mg/100 ml, respectively (Table 5). The serum cholesterol level between the two breeds did not differ statistically due to feeding of different rations. The mean (± SE) values of serum cholesterol in combined breeds viz. NZ and SC maintained on. Ration 1, 2, 3, 4and 5 on 0 day were 46.407 ± 0.593, 45.772 ± 0.839, 45.998 ± 0.454, 46.275 ± 0.531 and 45.743 ± 0.401 mg/100 ml, respectively. The serum cholesterol value of the combined breeds did not differ significantly at 0 day of the trial. The mean (± SE) values of serum cholesterol in NZ breed maintained with Ration 1, 2, 3, 4 and 5 on 22nd day of the experiment were 51.160 ± 1.030, 51.807 ± 2.362, 51.073 ± 2.782, 54.260 ± 2.534 and 53.937 ± 3.423 mg/100 ml, respectively. The respective value in SC breed were 50.573 ± 1.819, 54.037 ± 2.426, 53.463 ± 2.333, 52.377 ± 2.037 and 55.480 ± 1.444 mg/100 ml, respectively. The serum cholesterol level between the two breeds did not show any significant effect due to feeding of different rations.

Table 5: The Mean ± S.E. Value of serum Cholesterol (mg/100 ml) in Experimental Rabbits of Different Groups

Attribute	Ration					Overall (Breed)
	1	2	3	4	5	
0 Day(Initial)						
NZ	46.073 ±0.472	45.513 ±0.705	46.477 ±0.628	46.337 ±0.644	45.310 ±0.497	45.942 ±0.256
SC	46.740 ±1.195	46.030 ±1.201	45.520 ±0.638	46.213 ±0.339	46.177 ±0.368	46.136 ±0.410
Overall (Ration)	46.407 ±0.593	45.772 ±0.839	45.998 ±0.454	46.275 ±0.531	45.743 ±0.401	46.039 ±0.262
22nd Day						
NZ	51.160 ±1.030	51.807 ±2.362	51.073 ±2.782	54.260 ±2.534	53.937 ±3.423	52.447 ±1.032
SC	50.573 ±1.819	54.037 ±2.426	53.463 ±2.333	52.377 ±2.037	55.480 ±1.444	53.186 ±0.889
Overall (Ration)	50.867 ±0.944	52.922 ±1.594	52.268 ±1.709	53.318 ±1.514	54.708 ±1.697	52.817 ±0.672
45th Day						
NZ	52.933 ±1.392	52.933 ±0.425	53.833 ±1.889	57.467 ±1.225	57.600 ±0.709	54.953 ±0.979
SC	56.867 ±0.825	54.033 ±0.933	57.467 ±0.857	54.267 ±2.446	55.867 ±0.667	55.700 ±0.612
Overall (Ration)	54.900 ±1.139	53.483 ±0.586	55.650 ±1.233	55.867 ±1.417	56.733 ±0.583	55.307 ±0.608

N.B. Sub-class averages with at least one superscripts in common (lower case along the row and upper case along the column) do not differ significantly.

The mean (± SE) value of serum cholesterol in combined breeds viz. NZ and SC maintained on Ration 1, 2, 3, 4 and 5 on 22nd day were 50.867 ± 0.944, 52.922 ± 1.594, 52.268 ± 1.709, 53.318 ± 1.514 and 54.708 ± 1.697 mg/100 ml, respectively. The serum cholesterol value of the combined breeds did not differ significantly at 22nd day of the feeding trial. The mean (± SE) values of serum cholesterol in NZ breed maintained with Ration 1, 2, 3, 4 and 5 on 45th day of the experiment were 52.933 ± 1.392, 52.933 ± 0.425, 53.833± 1.889, 57.467 ± 1.225 and 57.600 ± 0.709 mg/100 ml, respectively. The respective values in SC breed were 56.867 ± 0.825, 54.033 ± 0.933, 57.467 ± 0.857, 54.267 ± 2.446 and 55.867 ± 0.667 mg/100 ml, respectively. The serum cholesterol value between the two breeds, did not affect significantly due to feeding of different rations. The mean (± SE) values of serum cholesterol in combined breeds viz. NZ and SC maintained on Ration 1, 2, 3, 4 and 5 on 45th day were 54.900 ± 1.139, 53.483 ± 0.586, 55.650 ± 1.233, 55.867 ± 1.417 and 56.733 ± 0.583 mg/100 ml, respectively. The serum cholesterol value of the combined breeds did not differ statistically at 45th day of the feeding trial.

Cholesterol is a steroid distributed throughout the body which helps in digestion and transportation of fats and it also serves as a precursor of many other steroids, steroid hormones and bile acids. The determination of serum cholesterol is considered to be significant in coronary artery disease, hyperlipo-proteinaemias, hypothyroidism, nephritis, diabetes mellitus and various liver diseases. Hypo-cholesterolemia (low serum cholesterol) is found in pernicious anaemia, haemolytic jaundice, malnutrition, acute infections and hypothyroidism. Normal cholesterol levels are affected by stress, age, gender, hormonal balance and pregnancy (Henry *et al*., 1974).

In view of the importance of cholesterol it was planned to study the effect of sweet potato feeding on serum cholesterol, if any. The present study reveals that replacement of maize with sweet potato in rabbit ration did not affect the serum cholesterol. The average values of serum cholesterol recorded in the present study (Table 5) were within the range

reported by Burroghs (1971), Raghuramulu *et al*. (1983), Saikia (1998) and Bora *et al.* (2001). Statistically no significant difference was observed among the groups at 0 day, 22nd day and at 45th day (Table 4.54) due to breed, ration and ration x breed. El-Rahim *et al*. (1991) reported that feeding diets containing cassava replacing barley grain showed no significant effect on total lipid of blood in growing NZW rabbits. Earlier works of Gowda *et al*. (1996a) feeding raw or urea ammoniated mustard meal, Saikia (1996) feeding diets containing ajar seed replacing maize up to 50 per cent and Saikia (1998) replacing wheat grain with ajar seed kernel reveals that, replacement of conventional feed with unconventional feed did not affect serum cholesterol level. Thus, the results of the present experiment clearly demonstrate that boiled sweet potato could be incorporated into the ration of rabbits to replace maize grain up to 100 per cent without causing adverse affect on cholesterol metabolism.

Blood Glucose: The mean (± SE) values of blood glucose in NZ breed maintained with Ration 1, 2, 3, 4 and 5 on 0 day of the experiment were 81.707 ± 0.594, 81.767 ± 0.656, 80.887 ± 0.373, 81.507 ± 0.655 and 82.137 ± 0.603 mg/100 ml, respectively. The respective values in SC breed were 81.383 ± 0.723, 81.047 ± 0.208, 80.963 ± 0.244, 80.797 ± 0.968 and 80.317 ± 0.439 mg/100 ml, respectively (Table 6). The statistical analysis did not show any significant difference due to feeding of different rations. The mean (± SE) values of blood glucose in combined breed viz. NZ and SC maintained on Ration 1, 2, 3, 4 and 5 on 0 day were 81.545 ± 0.425, 81.407 ± 0.347, 80.925 ± 0.200, 81.152 ± 0.546 and 81.227 ± 0.526, respectively, which did not differ significantly at 0 day of the trial.

The mean (± SE) values of blood glucose in NZ breed maintained with Ration 1, 2, 3, 4 and 5 on 22nd day of the experiment were 84.793 ± 0.705, 84.630 ± 0.907, 83.610 ± 1.154, 82.857 ± 0.988 and 85.693 ± 1.161 mg/100 ml, respectively. The respective value in SC breed were 83.500 ± 0.580, 83.650 ± 0.624, 86.047 ± 0.121, 85.240 ± 1.332 and 84.520 ± 1.848 mg/100 ml, respectively, but no significant effect have been fund due to feeding of different rations. The mean (± SE) values of blood glucose in combined breeds viz. NZ and SC maintained on Ration 1, 2, 3, 4 and 5 on 22nd day were 84.147 ± 0.500, 84.140 ± 0.717, 84.828 ± 0.753, 84.048 ± 0.913 and 85.107 ± 1.011 mg/100 ml, respectively. The blood glucose values of the combined breeds did not shown any significant difference at 22nd day of the feeding trial. The mean (± SE) values of blood glucose in NZ breed maintained with Ration 1, 2, 3, 4 and 5 rations on 45th day of the experiment were 84.467 ± 0.334, 89.033 ± 0.334, 87.033 ± 1.689, 84.700 ± 1.626 and 86.333 ± 1.453 mg/100 ml, respectively, and did not shown significant difference due to feeding of different rations. The mean (± SE) value of blood glucose in combined breeds viz. NZ and SC maintained on Ration 1, 2, 3, 4 and 5 on 45th day were 84.183 ± 0.215, 87.333 ± 0.867, 87.117 ± 0.868, 85.100 ± 0.848 and 86.350 ± 0.950 mg/100 ml respectively, which was not significant statistically.

Table 6: The Mean ± S.E. Value of Blood Glucose (Mg/100 Ml) In Experimental Rabbits of Different Groups

Attribute	Ration					Overall (Breed)
	1	2	3	4	5	
0 Day(Initial)						
NZ	81.707 ±0.594	81.767 ±0.656	80.887 ±0.373	81.507 ±0.655	82.137 ±0.603	81.601 ±0.247
SC	81.383 ±0.723	81.047 ±0.208	80.963 ±0.244	80.797 ±0.968	80.317 ±0.439	80.901 ±0.243
Overall (Ration)	81.545 ±0.425	81.407 ±0.347	80.925 ±0.200	81.152 ±0.546	81.227 ±0.526	81.251 ±0.182
22nd Day						
NZ	84.793 ±0.705	84.630 ±0.907	83.610 ±1.154	82.857 ±0.988	85.693 ±1.161	84.317 ±0.656
SC	83.500 ±0.580	83.650 ±0.624	86.047 ±0.121	85.240 ±1.332	84.520 ±1.848	84.591 ±0.485
Overall (Ration)	84.147 ±0.500	84.140 ±0.717	84.828 ±0.753	84.048 ±0.913	85.107 ±1.011	84.454 ±0.404
45th Day						
NZ	84.467 ±0.334	89.033 ±0.334	87.033 ±1.689	84.700 ±1.626	86.333 ±1.453	86.353 ±0.651
SC	83.900 ±0.199	85.633 ±0.868	87.200 ±0.951	85.500 ±0.889	86.167 ±1.539	85.680 ±0.470
Overall (Ration)	84.183 ±0.215	87.333 ±0.867	87.117 ±0.868	85.100 ±0.848	86.350 ±0.950	86.017 ±0.399

N.B. Sub-class averages with at least one superscripts in common (lower case along the row and upper case along the column) do not differ significantly.

In the present experiment the average value of blood glucose levels in the different experimental groups found to be ranged from 80.31 ± 0.44 to 89.03 ± 0.334 mg/100 ml (Table 4.58). These values were found to be within the normal range of reported values by Kozma *et al.* (1979), Raghuramulu *et al.* (1983), Harkness and Wagner (1989), Kalita (1998) and Bora *et al.* (2001).

However blood sugar level found to be higher along with the advancement of age/feeding trial in all the groups. Nasledova and Silnitsky (1972) stated that blood glucose concentration increased with the advancement of age. Higher blood sugar level in sweet potato incorporated groups might be due to higher amount of soluble carbohydrate (due to boiled sweet potato) ingested than the control group. There was no significant difference in blood glucose level at o day, 22nd day and 45th day of the feeding trial due to breed, ration and ration × breed. The present study reveals that replacement of maize with sweet potato in rabbit ration did not affect the blood glucose. Ekpenyong and Biobaku (1986) found no significant effect of feeding sewage sludge and dried poultry waste (10% level) on plasma glucose in rabbits. Ayyat (1994) reported that serum glucose level was not significantly differed in rabbit fed different levels of dietary protein. Gowda *et al.* (1996a) compared blood biochemical changes in rabbits fed diets containing raw and urea ammoniated deoiled mustard meal and concluded that raw mustard meal incorporation had no adverse effect on glucose value of blood. The present findings of blood glucose concentration in rabbit corroborated with the findings of above mentioned workers.

Serum Calcium: The mean (±SE) values of serum calcium in NZ breed maintained with Ration 1, 2, 3, 4 and 5 on 0 day of the experiment were 12.327 ± 0.083, 12.467 ± 0.058, 12.293 ± 0.041, 12.463 ± 0.048 and 12.407 ± 0.089 mg/100 ml, respectively. The respective value in SC breed were 12.490 ± 0.046, 12.407 ± 0.020, 12.440 ± 0.080, 12.377 ± 0.061 and 12.517 ± 0.059 mg/100 ml, respectively (Table 7). The serum calcium level, between the two breeds did not

differ statistically due to feeding different rations. The mean (± SE) values of serum calcium in combined breeds viz. NZ and SC maintained on Rations 1, 2, 3, 4 and 5 on 0 day of the experiment were 12.327 ± 0.083, 12.467 ± 0.058, 12.293 ± 0.041, 12.463 ± 0.048 and 12.407 ± 0.089 mg/100 ml, respectively. The respective value in SC breed were 12.490 ± 0.046, 12.407 ± 0.020, 12.440 ± 0.080, 12.377 ± 0.061 and 12.527 ± 0.059 mg / 100 ml, respectively. The serum calcium level between the two breeds had shown no significant difference due to feeding of different rations.

Table 7: The Mean ± S.E. Value of Serum Calcium (Mg/100 Ml) in Experimental Rabbits of Different Groups

Attribute	Ration					Overall (Breed)
	1	2	3	4	5	
0 Day (Initial)						
NZ	12.327 ±0.083	12.467 ±0.058	12.293 ±0.041	12.463 ±0.048	12.407 ±0.089	12.391 ±0.036
SC	12.490 ±0.046	12.407 ±0.020	12.440 ±0.080	12.377 ±0.061	12.527 ±0.059	12.448 ±0.026
Overall (Ration)	12.408 ±0.056	12.437 ±0.031	12.367 ±0.052	12.420 ±0.054	12.467 ±0.055	12.420 ±0.022
22nd Day						
NZ	12.350 ±0.055	12.413 ±0.059	12.400 ±0.100	12.487 ±0.049	12.403 ±0.069	12.411 ±0.029
SC	12.430 ±0.035	12.370 ±0.035	12.437 ±0.067	12.370 ±0.040	12.483 ±0.064	12.418 ±0.022
Overall (Ration)	12.390 ±0.034	12.392 ±0.032	12.418 ±0.054	12.428 ±0.039	12.443 ±0.046	12.414 ±0.018
45th Day						
NZ	12.333 ±0.067	12.367 ±0.033	12.367 ±0.033	12.400 ±0.003	12.333 ±0.033	12.360 ±0.016
SC	12.367 ±0.033	12.300 ±0.000	12.333 ±0.033	12.333 ±0.033	12.367 ±0.033	12.340 ±0.020
Overall (Ration)	12.350 ±0.034	12.333 ±0.021	12.350 ±0.026	12.367 ±0.021	12.350 ±0.030	12.350 ±0.013

N.B. Sub-class averages with at least one superscripts in common (lower case along the row and upper case along the column) do not differ significantly.

The mean (± SE) values of serum calcium in combined breeds viz. NZ and SC maintained on Rations 1, 2, 3, 4 and 5 on 0 day were 12.408 ± 0.056, 12.437 ± 0.031, 12.367 ± 0.052, 12.420 ± 0.054 and 12.467 ± 0.055 mg/100 ml, respectively. The serum calcium value of the combined breeds did not shown significant difference at 0 day of the trial. The mean (±SE) values of serum calcium in NZ breed maintained with Ration 1, 2, 3, 4 and 5 on 22nd day of the experiment were 12.350 ± 0.055, 12.413 ± 0.059, 12.400 ± 0.100, 12.487 ± 0.049 and 12.403 ± 0.069 mg/100 ml, respectively. The respective value in SC breed were 12.430 ± 0.035, 12.370 ± 0.035, 12.437 ± 0.067, 12.370 ± 0.040 and 12.483 ± 0.064 mg/100 ml, respectively. The serum calcium level, between the two breeds, did not differ statistically due to feeding of different rations.

The mean (±SE) valued of serum calcium in combined breeds viz. NZ and SC maintained on Ration 1, 2, 3, 4 and 5 on 22nd day were 12.390 ± 0.034, 12.392 ± 0.032, 12.418 ± 0.054, 12.428± 0.039 and 12.443 ± 0.046 mg / 100 ml, respectively. The serum calcium value of the combined breeds did not differ significantly at 22nd day of the feeding trial. The mean (±SE) values of serum calcium in NZ breed maintained with Ration 1, 2, 3, 4 and 5 on 45th day of the experiment were 12.333 ± 0.067, 12.367 ± 0.033, 12.367 ± 0.033, 12.400 ± 0.003 and 12.333 ± 0.033 mg/100 ml, respectively. The respective value in SC breed were 12.367 ± 0.033, 12.300 ± 0.000, 12.333 ± 0.033, 12.333 ± 0.033 and 12.367 ± 0.033 mg/100 ml, respectively. The serum calcium level, between the two breeds, did not have any significant

effect on feeding of different rations. The mean (±SE) values of serum calcium in combined breeds viz. NZ and SC maintained on Rations 1, 2, 3, 4 and 5 on 45th day were 12.350 ± 0.034, 12.333 ± 0.021, 12.350 ± 0.026, 12.367 ± 0.021 and 12.350 ± 0.030 mg/100 ml, respectively. The serum calcium value of the combined breeds did not shown significant difference at 45th day of the feeding trial.

In the present experiment the average value of serum calcium (mg/100 ml) observed in rabbits of different groups at different intervals were within the reported range of Harkness and Wagner, 1980 (5.6 to 12.5 mg/100 ml), Chiericato *et al*., 1985 (12.21mg/100 ml), Dutta, 1996 (12.30 to 12.48 mg/100 ml) and Prabhakaran *et al*., 1997 (10.4 ± 0.3 to 11.7 ± 0.4 mg/100 ml) in rabbits. Statistically there was no significant difference among the groups at initial values and at subsequent intervals due to breed, ration and ration × breed (Table 7). Chiericato *et al*. (1985) reported that breed did not affect the blood values. Chiericato *et al*. (1993) in another study stated that the serum calcium levels had higher concentration during the early part of the life but there was no significant interaction between sex and age. Dutta (1996) opined that when rabbits were offered concentrate pelleted ration *ad lib.* 50% concentrate pelleted feed plus *ad lib* dub grass and only dub grass *ad lib* found no significant difference between the groups. The present findings are in agreement with the previous workers and thus boiled sweet potato incorporation in rabbits diets had no adverse effect on calcium metabolism.

Serum Phosphorus: The mean (±SE) values of serum phosphorus in NZ breed maintained with Ration 1, 2, 3, 4 and 5 on 0 day of the experiment were 5.460 ± 0.032, 5.490 ± 0.075, 5.603 ± 0.058, 5.463 ± 0.024 and 5.610 ± 0.035 mg/100 ml, respectively. The respective values in SC breed were 5.437 ± 0.088, 5.477 ± 0.017, 5.450 ± 0.085, 5.470 ± 0.071 and 5.533 ± 0.061 mg/100 ml, respectively (Table 8). The serum phosphorus level, between the two breeds did not differ statistically due to feeding different rations. The mean (±SE) values of serum phosphorus in combined breeds viz. NZ and SC maintained on Ration 1, 2, 3, 4 and 5 on 0 day were 5.448 ± 0.042, 5.483 ± 0.035, 5.527 ± 0.057, 5.467 ± 0.033 and 5.572 ± 0.036 mg/100 ml, respectively. The mean (±SE) values of serum phosphorus in NZ breed maintained with Ration 1, 2, 3, 4 and 5 on 22nd day of the experiment were 5.443 ± 0.037, 5.433 ± 0.092, 5.593 ± 0.035, 5.403 ± 0.004 and 5.473 ± 0.120 mg/100 ml, respectively. The respective value in SC breed were 5.487 ± 0.123, 5.500 ± 0.105, 5.403 ± 0.081, 5.600 ± 0.110 and 5.647± 0.060 mg/100 ml, respectively, but the serum phosphorus level, between the two breeds, did not differ statistically on feeding of different rations.

Table 8: The Mean ± S.E. Value of Serum Phosphorus (Mg/100 Ml) in Experimental Rabbits of Different Groups

Attribute	Ration					Overall (Breed)
	1	2	3	4	5	
0 Day (Initial)						
NZ	5.460 ±0.032	5.490 ±0.075	5.603 ±0.058	5.463 ±0.024	5.610 ±0.035	5.525 ±0.030
SC	5.437 ±0.088	5.477 ±0.017	5.450 ±0.085	5.470 ±0.071	5.533 ±0.061	5.473 ±0.029
Overall (Ration)	5.448 ±0.042	5.483 ±0.035	5.527 ±0.057	5.467 ±0.033	5.572 ±0.036	5.499 ±0.021
22nd Day						
NZ	5.443 ±0.037	5.433 ±0.092	5.593 ±0.035	5.403 ±0.004	5.473 ±0.120	5.469 ±0.032
SC	5.487 ±0.123	5.500 ±0.105	5.403 ±0.081	5.600 ±0.110	5.647 ±0.060	5.527 ±0.044
Overall (Ration)	5.465 ±0.058	5.467 ±0.064	5.498 ±0.058	5.502 ±0.066	5.560 ±0.071	5.498 ±0.027

Table 8: Contd.,						
45th Day						
NZ	5.487 ±0.072	5.390 ±0.021	5.617 ±0.055	5.503 ±0.083	5.533 ±0.087	5.506 ±0.032
SC	5.417 ±0.147	5.563 ±0.084	5.480 ±0.050	5.597 ±0.079	5.643 ±0.029	5.540 ±0.040
Overall (Ration)	5.452 ±0.075	5.477 ±0.055	5.548 ±0.045	5.550 ±0.055	5.588 ±0.048	5.523 ±0.025

N.B. Sub-class averages with at least one superscripts in common (lower case along the row and upper case along the column) do not differ significantly.

The mean (±SE) values of serum phosphorus of combined breeds viz. NZ and SC maintained on Ration 1, 2, 3, 4 and 5 on day 22nd, were 5.465 ± 0.058, 5.467 ± 0.064, 5.498 ± 0.058, 5.502 ± 0.066 and 5.560 ± 0.071 mg/100 ml, respectively, which did not shown any significant effect at 22nd day of the feeding trial (Table 8). The mean (±SE) values of serum phosphorus in NZ breed maintained with Ration 1, 2, 3, 4 and 5 rations on 45th day of the experiment were 5.487 ± 0.072, 5.390 ± 0.021, 5.617 ± 0.055, 5.503 ± 0.083 and 5.533 ± 0.087 mg/100 ml, respectively. The respective value in SC breed were 5.417 ± 0.147, 5.563 ± 0.084, 5.480 ± 0.050, 5.597 ± 0.079 and 5.643 ± 0.029 mg/100 ml, respectively. The serum phosphorus level, between the two breeds, did not differ statistically due to feeding different rations. The mean (±SE) values of serum phosphorus combined breeds viz. NZ and SC maintained on Ration 1, 2, 3, 4 and 5 on 45th day were 5.452 ± 0.075, 5.477 ± 0.055, 5.548 ± 0.045, 5.550 ± 0.055 and 5.588 ± 0.048 mg/100 ml, respectively, when the statistical analysis revealed that no significant difference of serum phosphorus level at 45th day of the feeding trial.

CONCLUSIONS

The average values of serum phosphorus observed in rabbits of different groups in the present study were within the range (5.39 ± 0.02 to 5.65 ± 0.06 mg/100 ml) (Table 4.62) reported by Weishbroth *et al*. (1974), Harkness and Wagner (1980), Dutta (1996) and Prabhakaran *et al*. (1997). There was no significant difference among the breed, ration and ration × breed due to incorporation of sweet potato in the diet of rabbits. Dutta (1996) observed no significant difference in the phosphorus level in blood due to various dietary treatments. The present findings are also in agreement with the findings of other workers. Thus, the incorporation of sweet potato had no adverse effect on the phosphorus content in blood of rabbits.

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